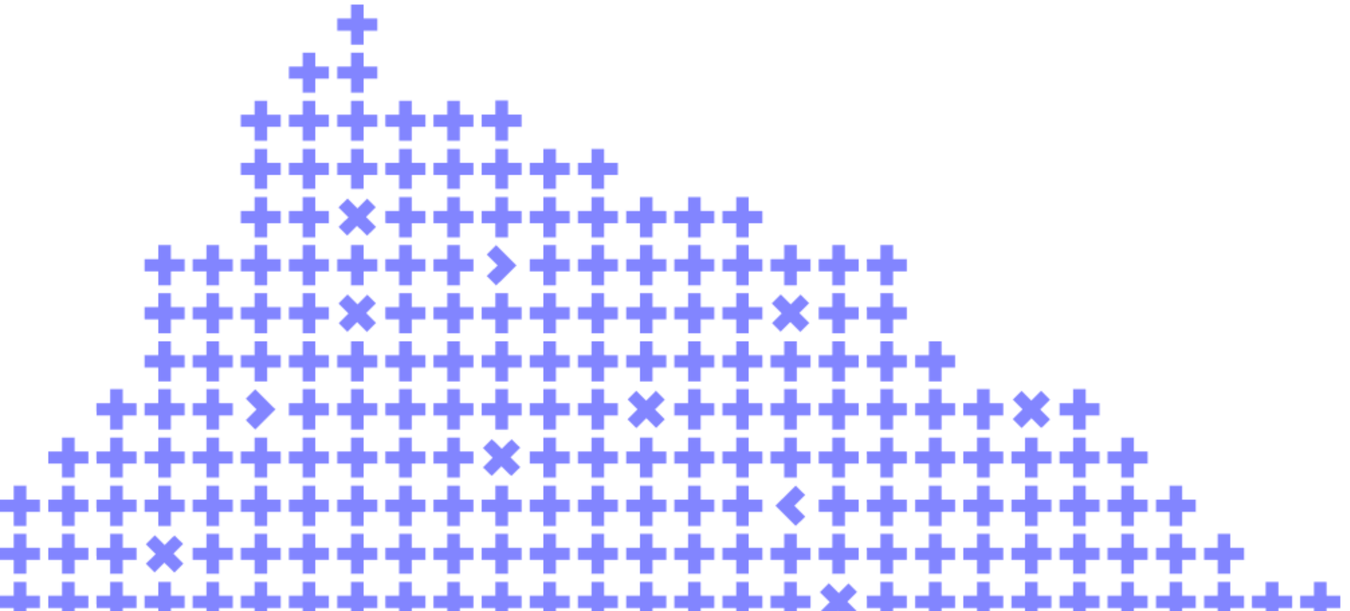
Perception system of a truly autonomous truck

Alexey Voropaev



High Load Armenia

Co-organizer

Yandex


EVOCARGO
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Enclosed Territories

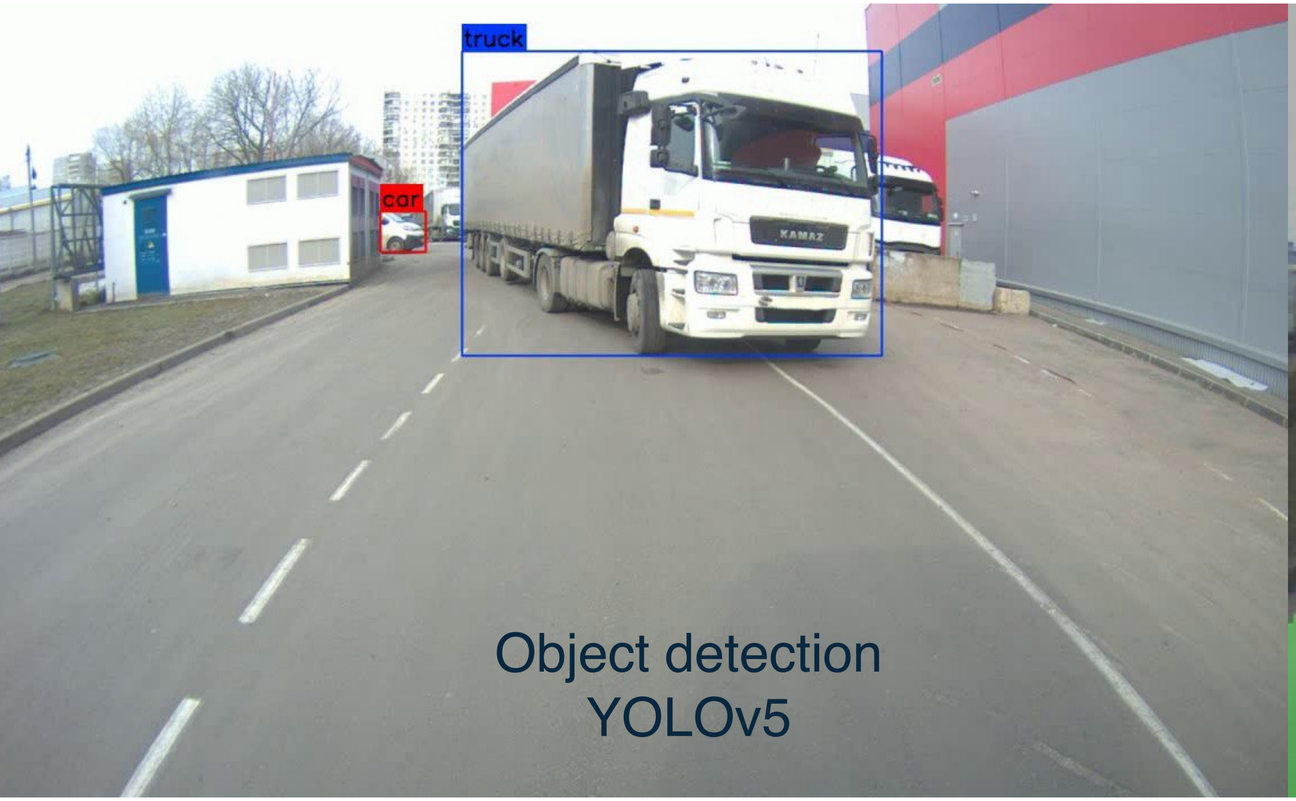
- Controlled environment
- Speed limits
- Lack of personnel

Evocargo

- Autonomous
- Electric
- 1.5 tons
- 25 km/h
- 200 km

Front camera

EVOCARGO

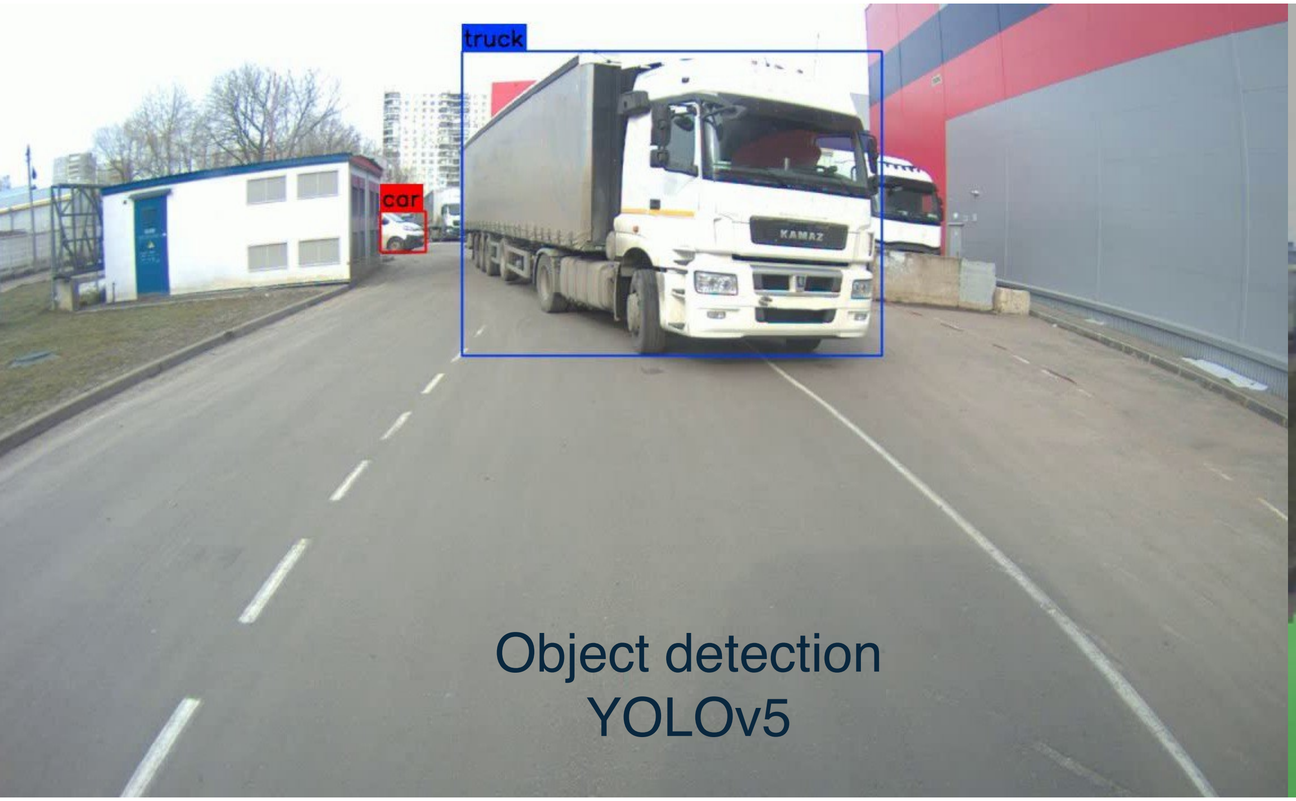


Object detection
YOLOv5

Image segmentation
PSPNet

Front camera

EVOCARGO



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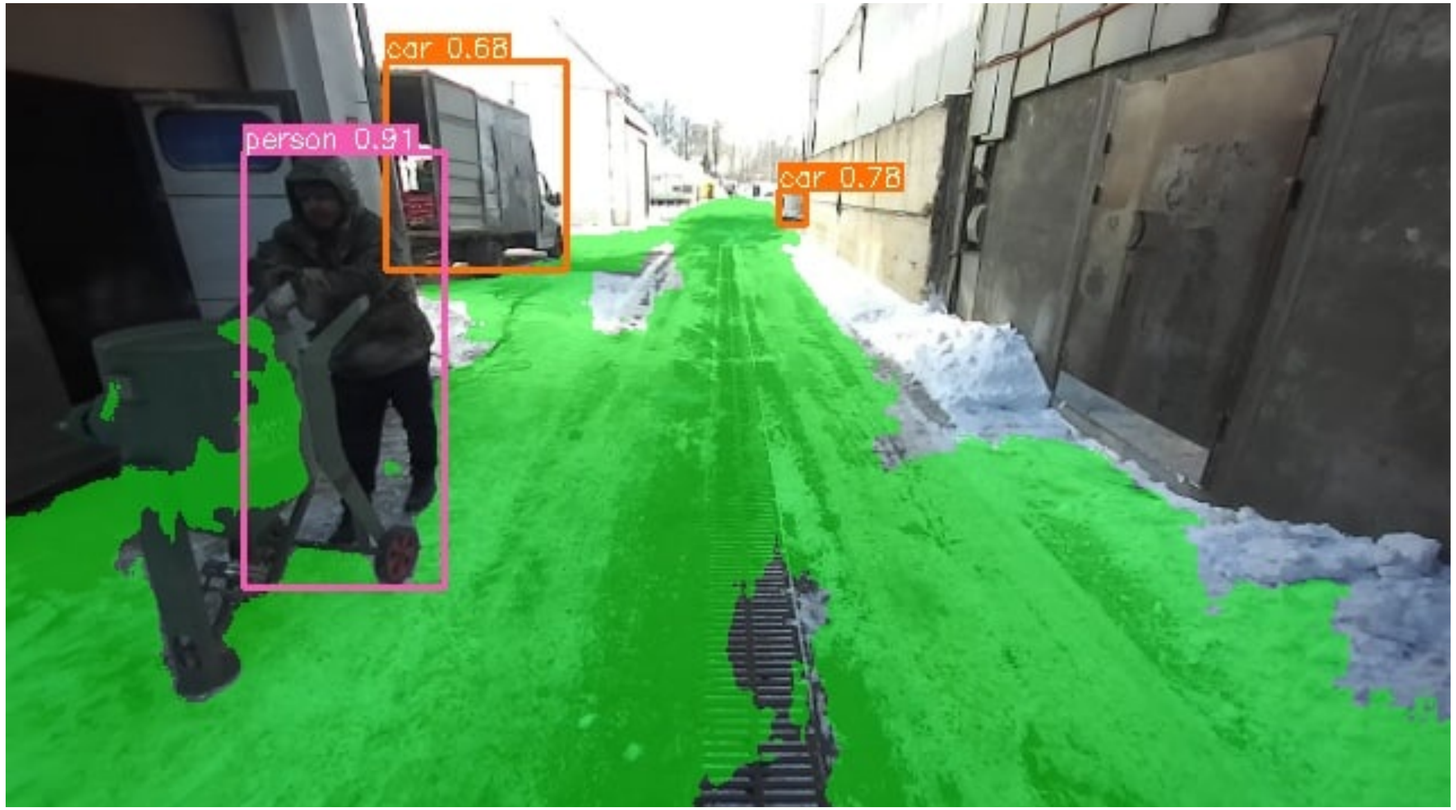
The Reality

EVOCARGO



The Reality

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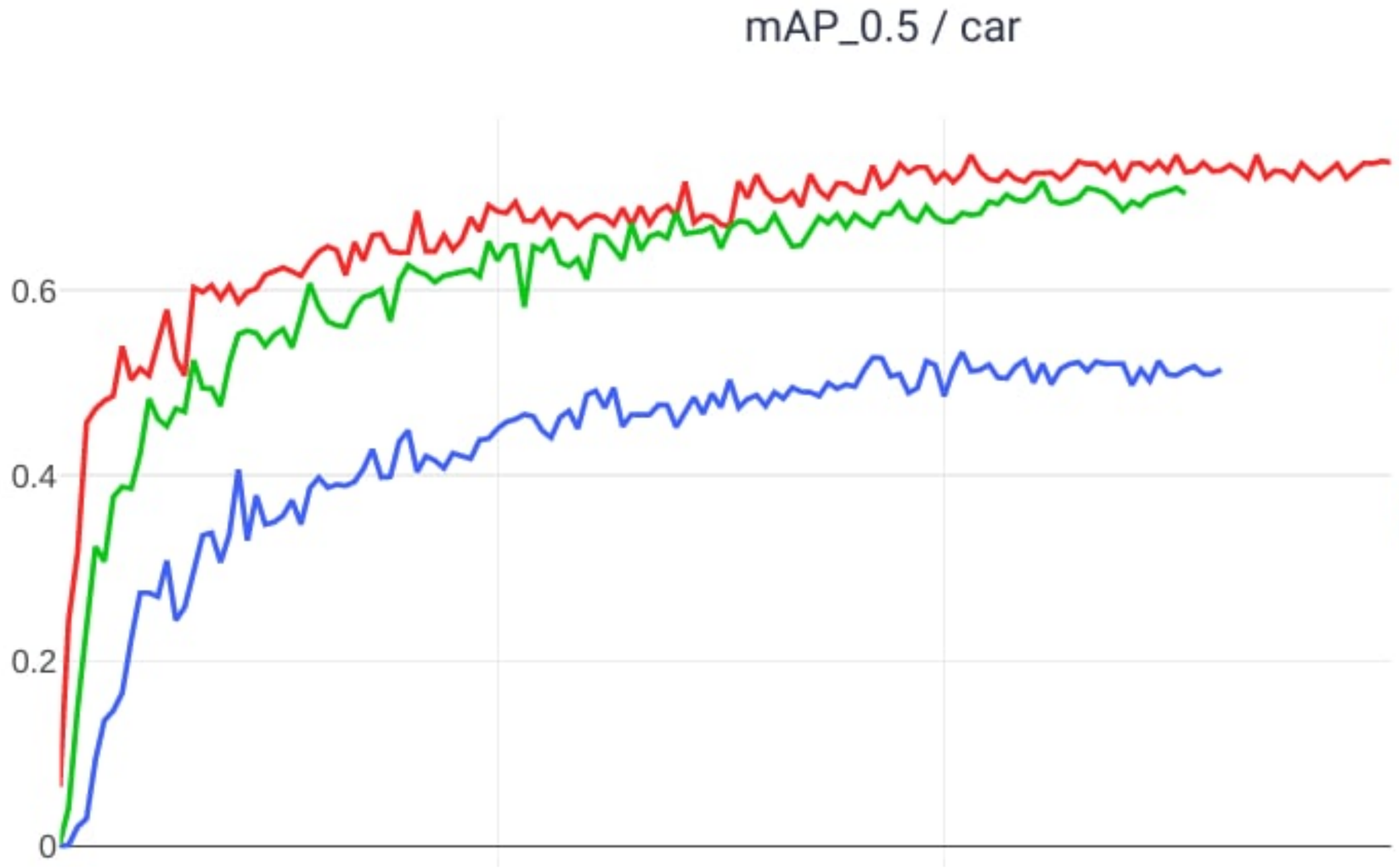
Size Matters

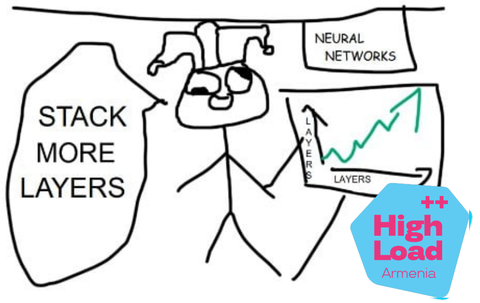
EVOCARGO



Model XL

Model S

Model L



Computation Unit

EVOCARGO

We are limited by GTX 1660 Super: no FP16, no INT8

And we can’t replace*:

- We need an industrial solution to operate at production 24/7
- We need to minimize costs
- Difficult to change construction

but we are looking for

++ High Load Armenia

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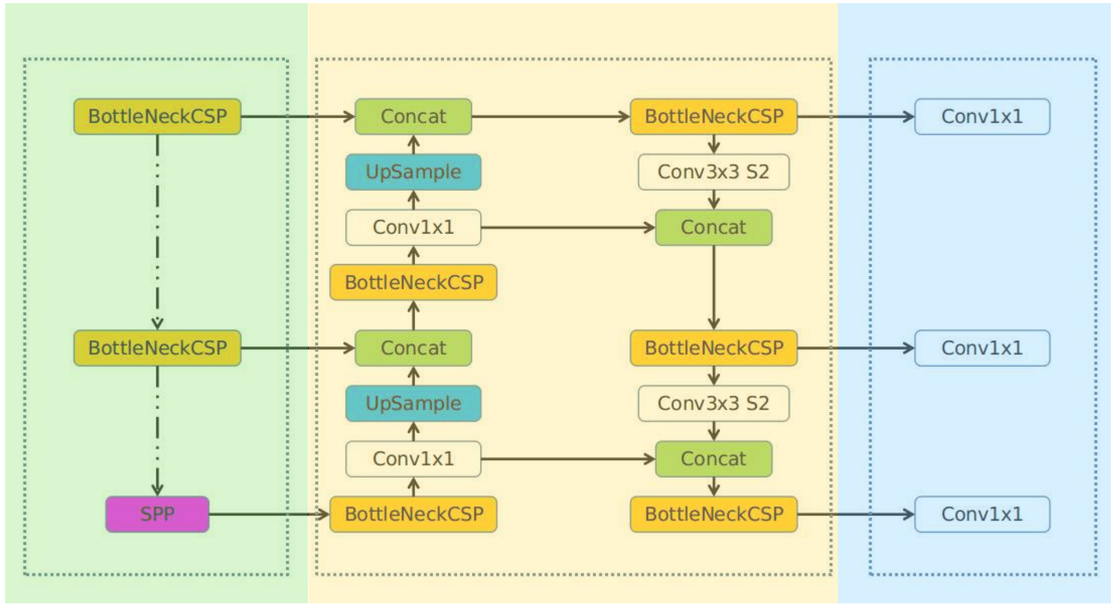
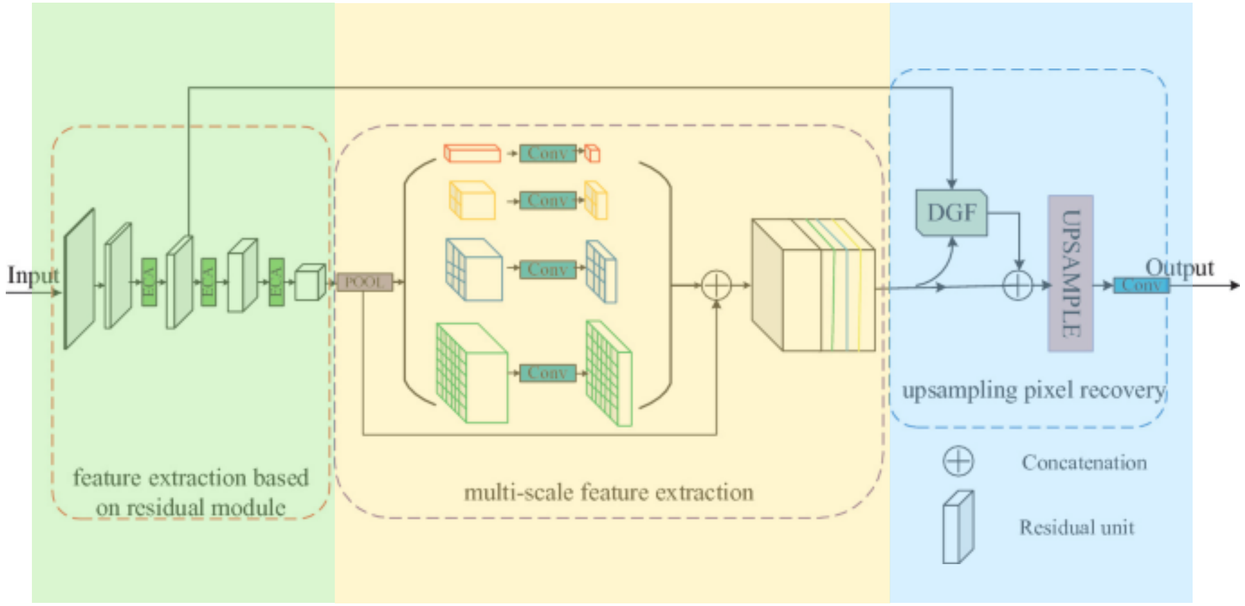
Backbone

EVOCARGO



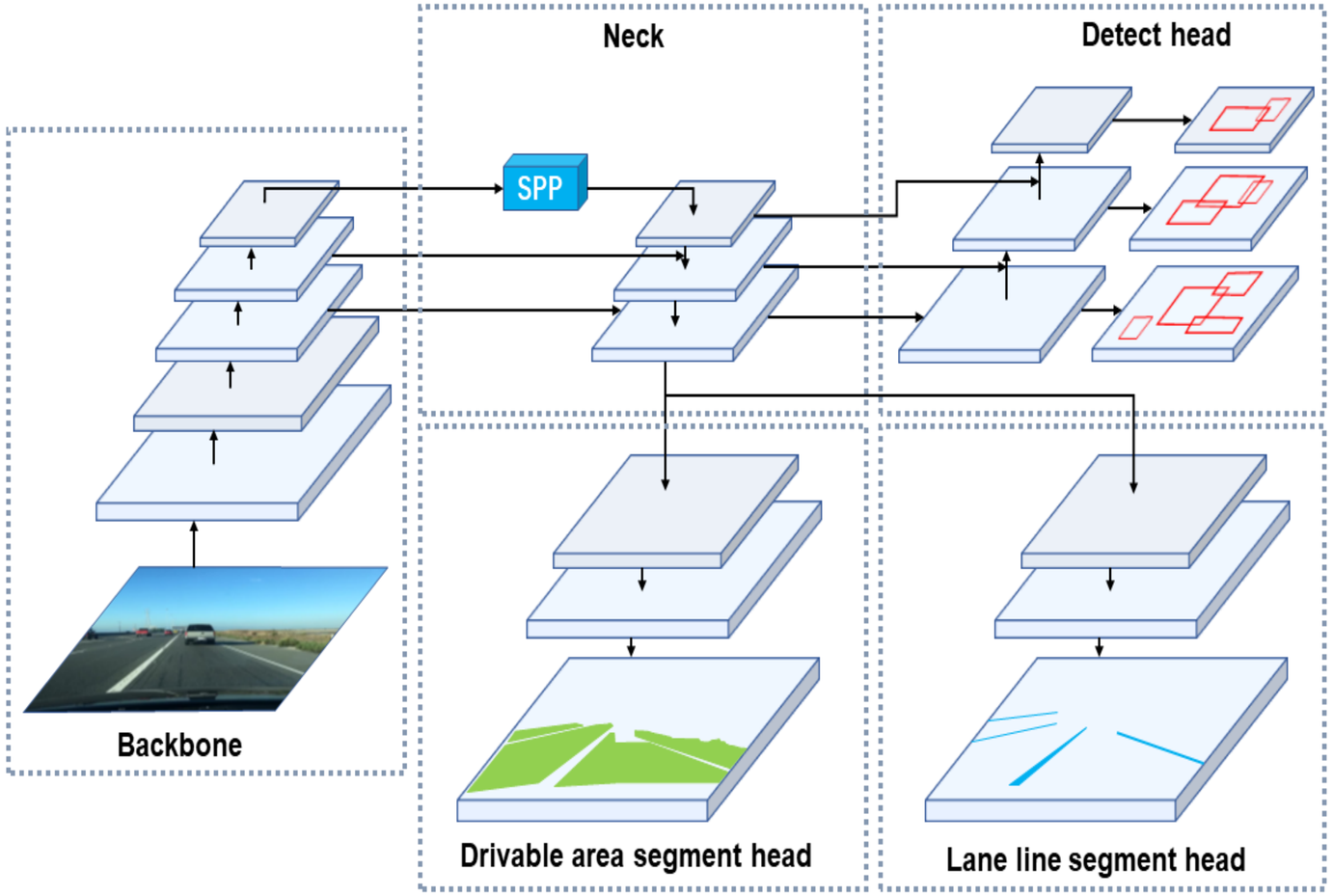
YOLOv5



PSPNet

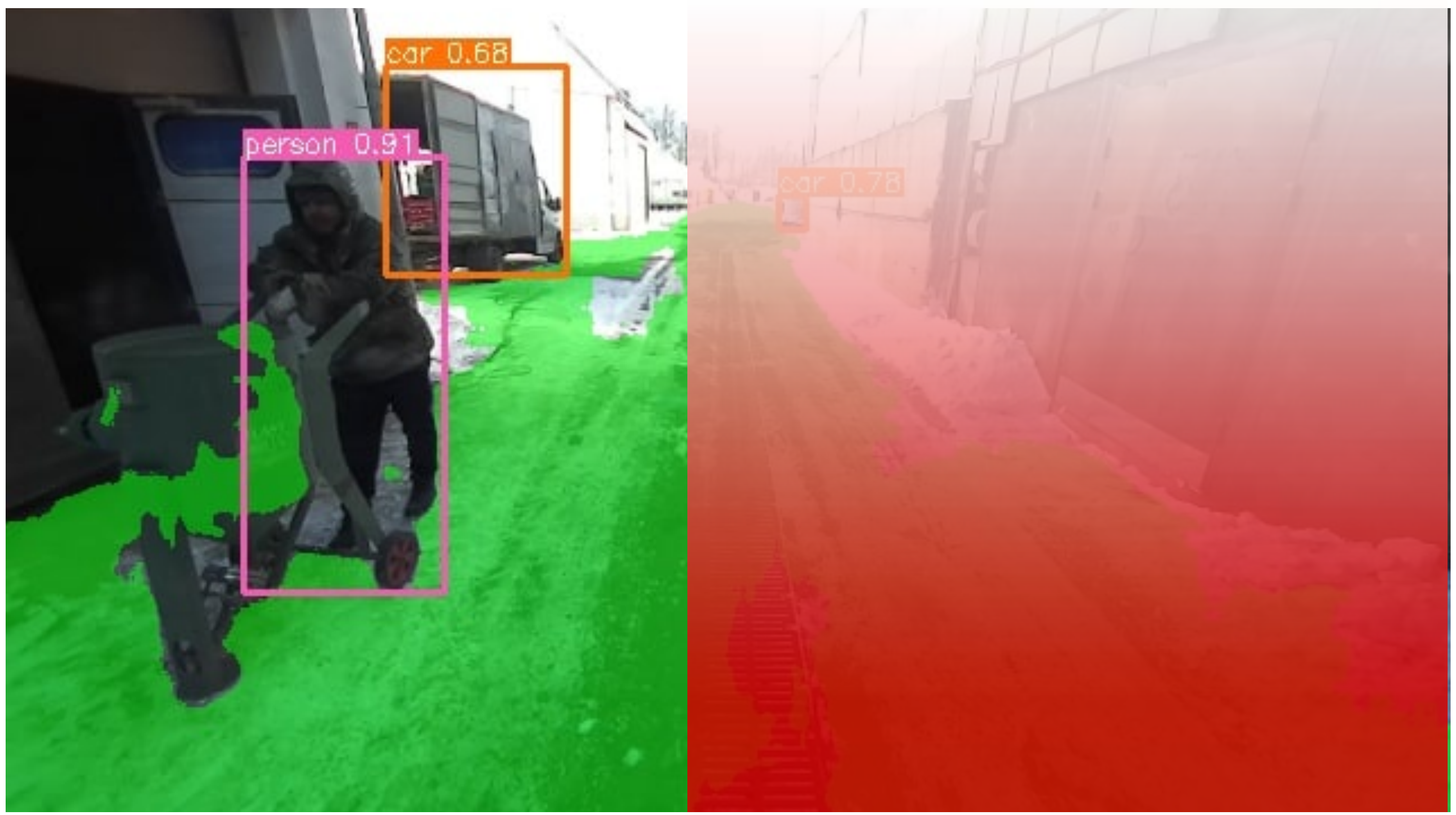
YoloP Model

EVOCARGO



Special Loss

EVOCARGO



Loss value importance

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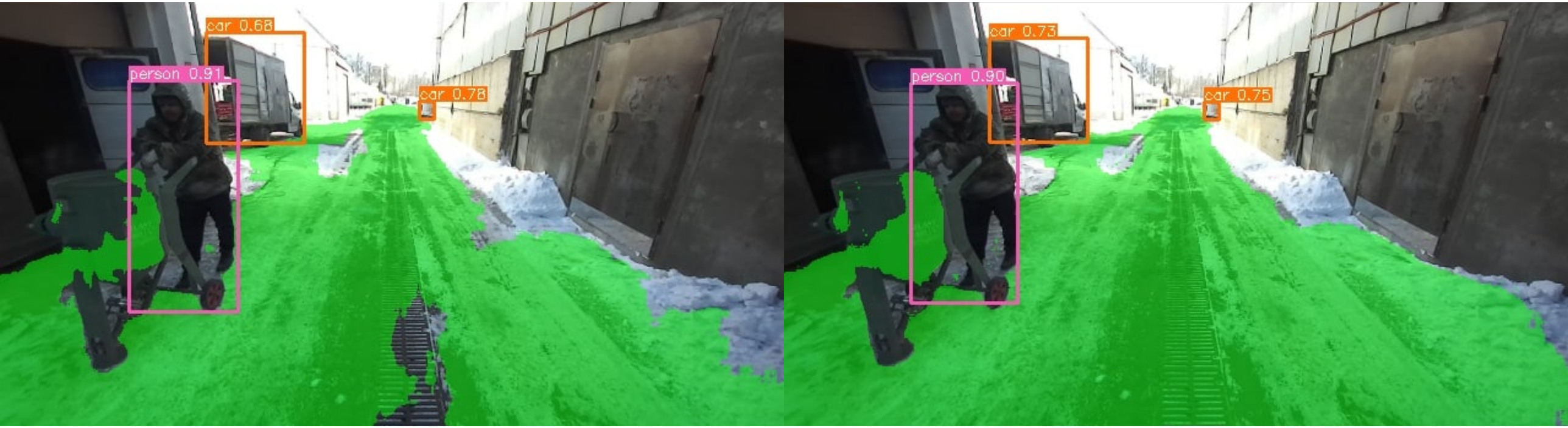
Special Loss

EVOCARGO



Before

After

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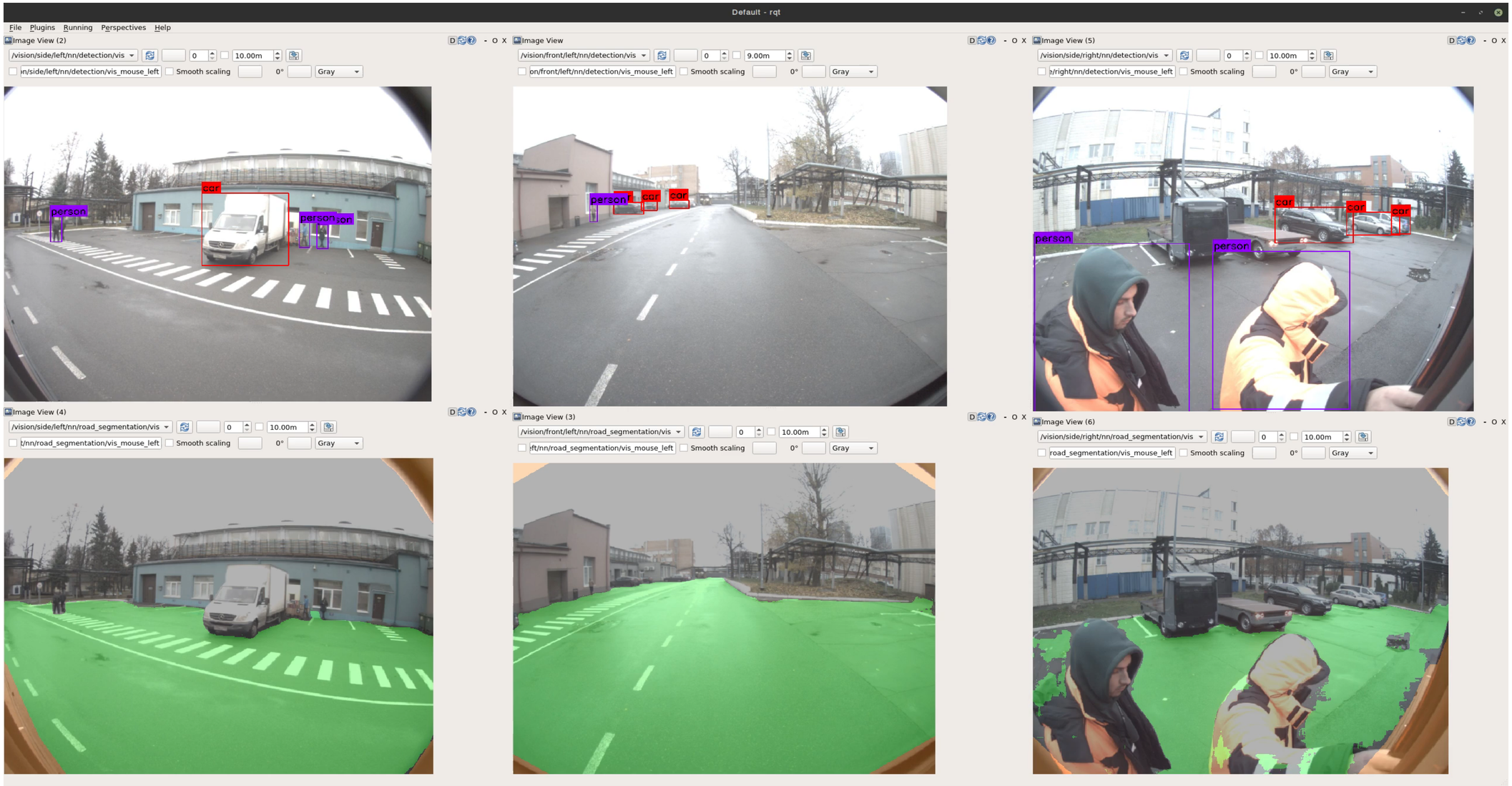
Results


Default - rqt
File Plugins Running Perspectives Help
Image View (2)
/vision/side/left/nn/detection/vis
Smooth scaling
Gray
car
person
person
person
Image View
/vision/front/left/nn/detection/vis
Smooth scaling
Gray
person
car
car
Image View (5)
/vision/side/right/nn/detection/vis
Smooth scaling
Gray
car
car
car
person
person
Image View (4)
/vision/side/left/nn/road_segmentation/vis
Smooth scaling
Gray
Image View (3)
/vision/front/left/nn/road_segmentation/vis
Smooth scaling
Gray
Image View (6)
/vision/side/right/nn/road_segmentation/vis
Smooth scaling
Gray

Performance

EVOCARGO

Model	Time, ms	TensorRT Time, ms	Detection mAP0.5	Segmentation IOU
Yolov5, fp32, 640x640	35.55	-	**0.722 / 0.753**	-
PSPNet	20.18	-	-	0.922
YOLOP_L fp32, 640x640	31.19	18.92	0.705/0.664	**0.939**
YOLOP_L fp32 384x640	19.00	**12,76**		

Performance

EVOCARGO

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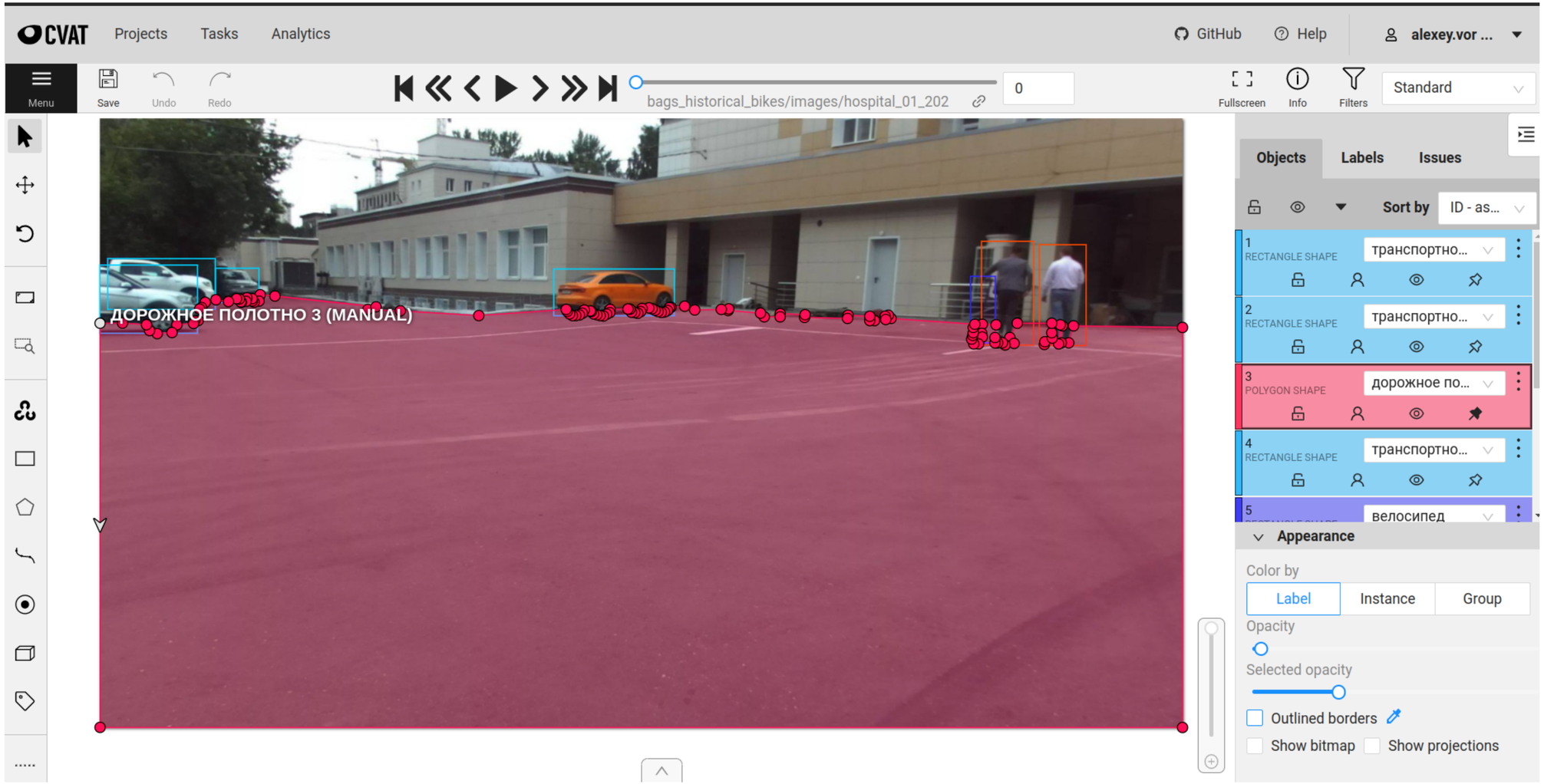
Dataset Annotation

EVOCARGO



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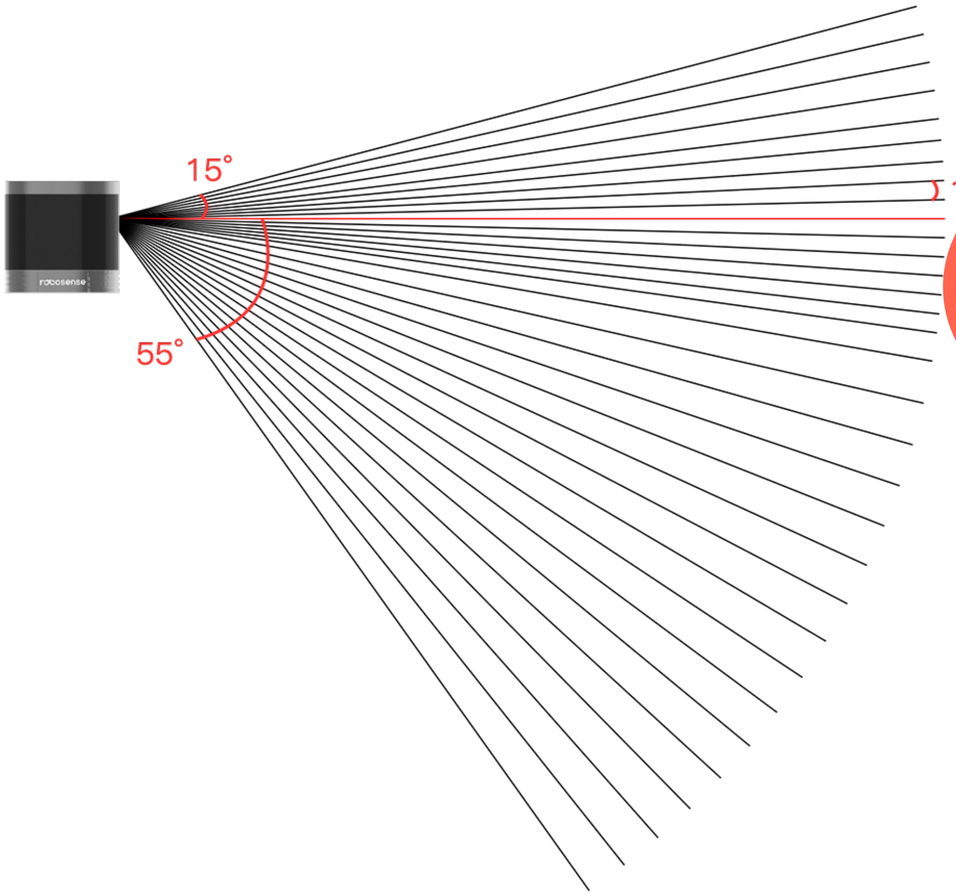
Lidar Sensor

EVOCARGO



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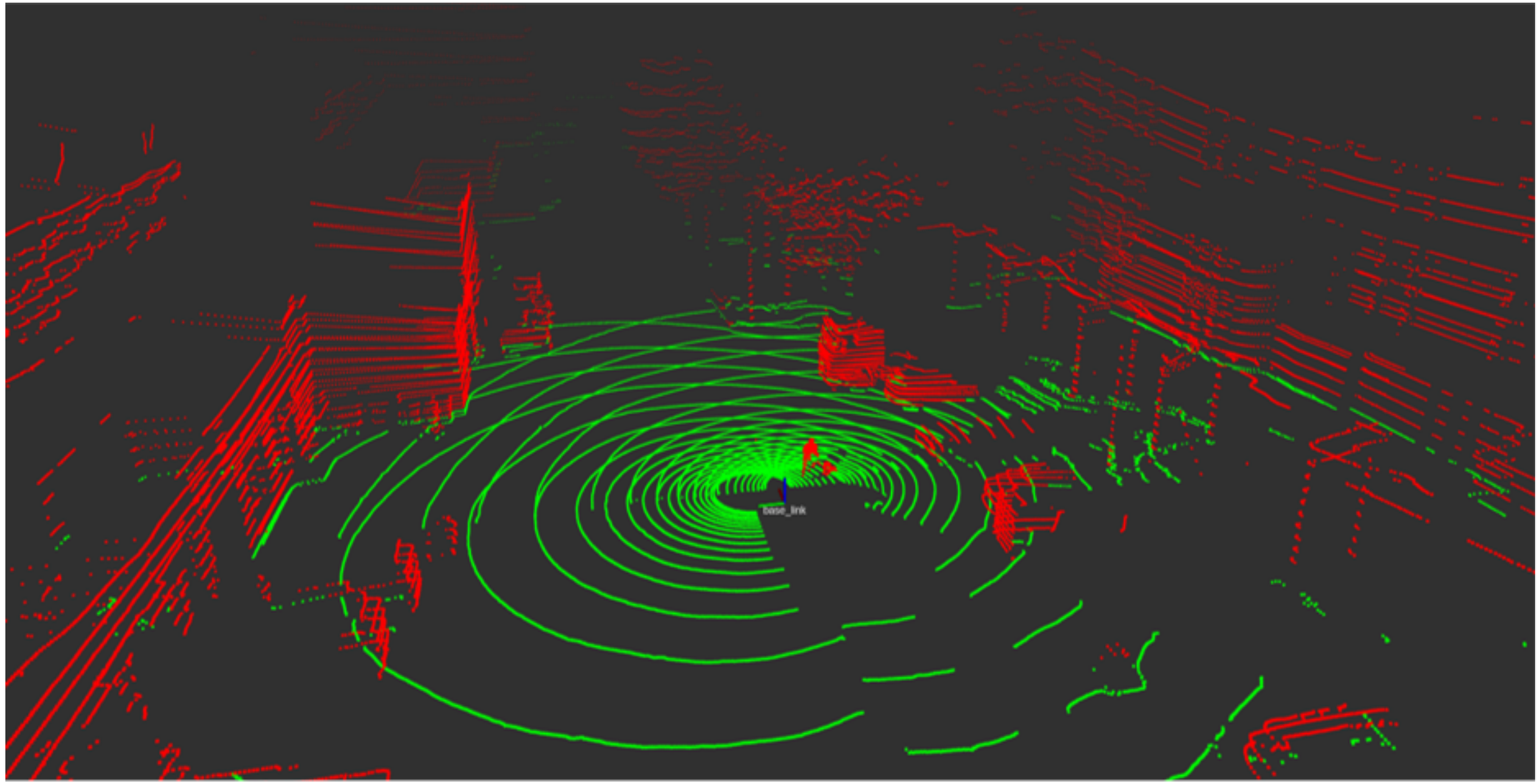
Drivable Area Segmentation

EVOCARGO



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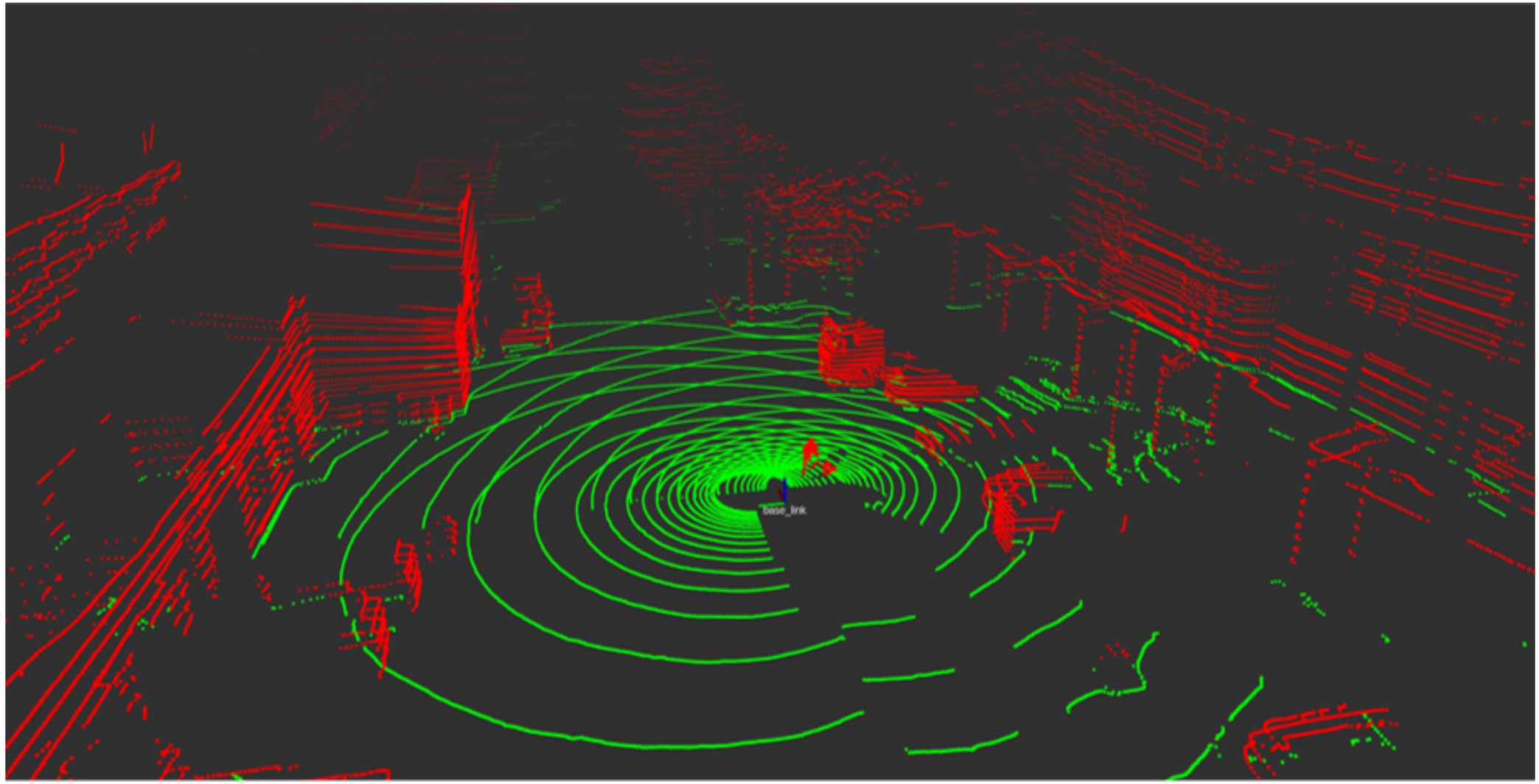
Drivable Area Segmentation

EVOCARGO



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Training Using Lidar

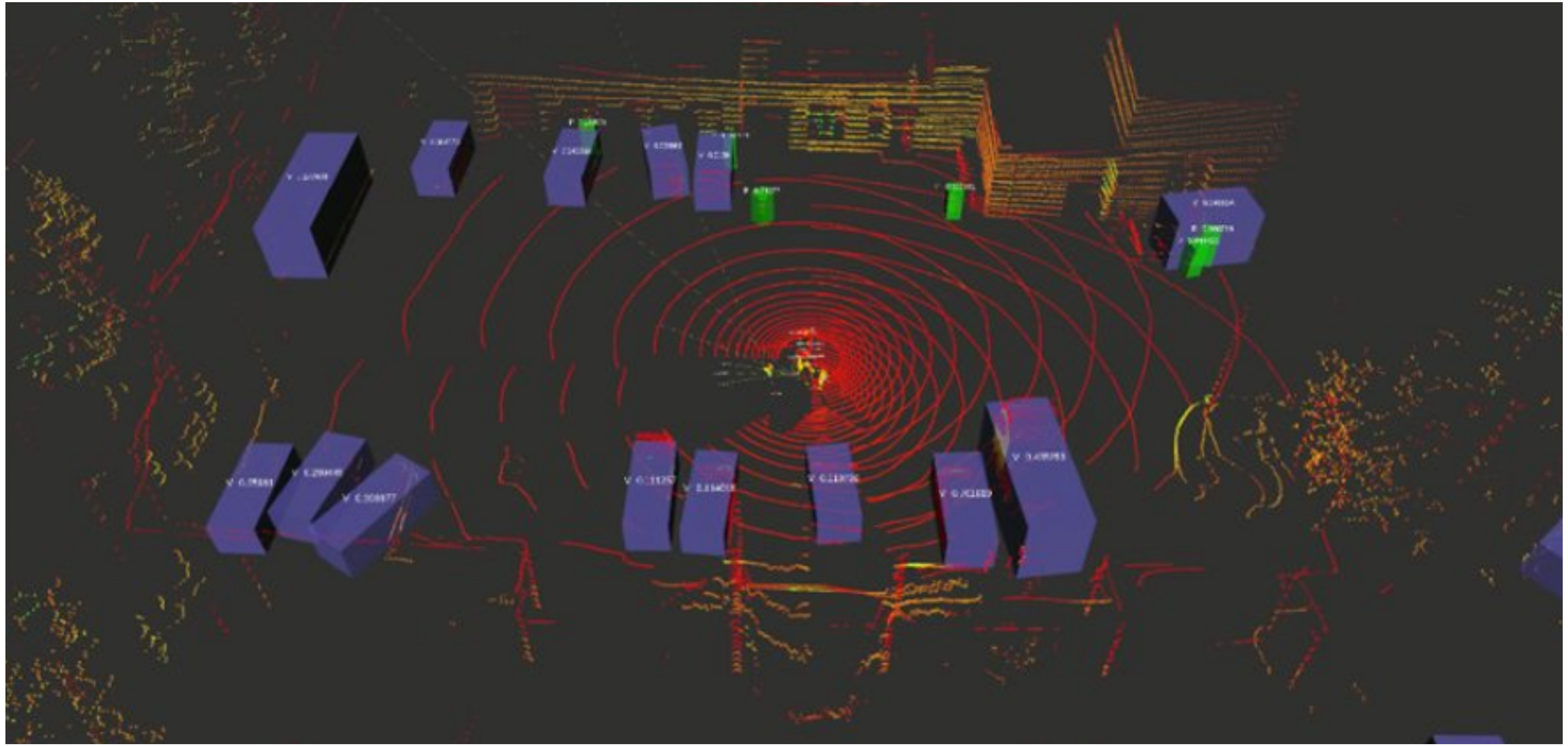
EVOCARGO

Training Using Lidar

EVOCARGO

Lidar Object Detection

EVOCARGO



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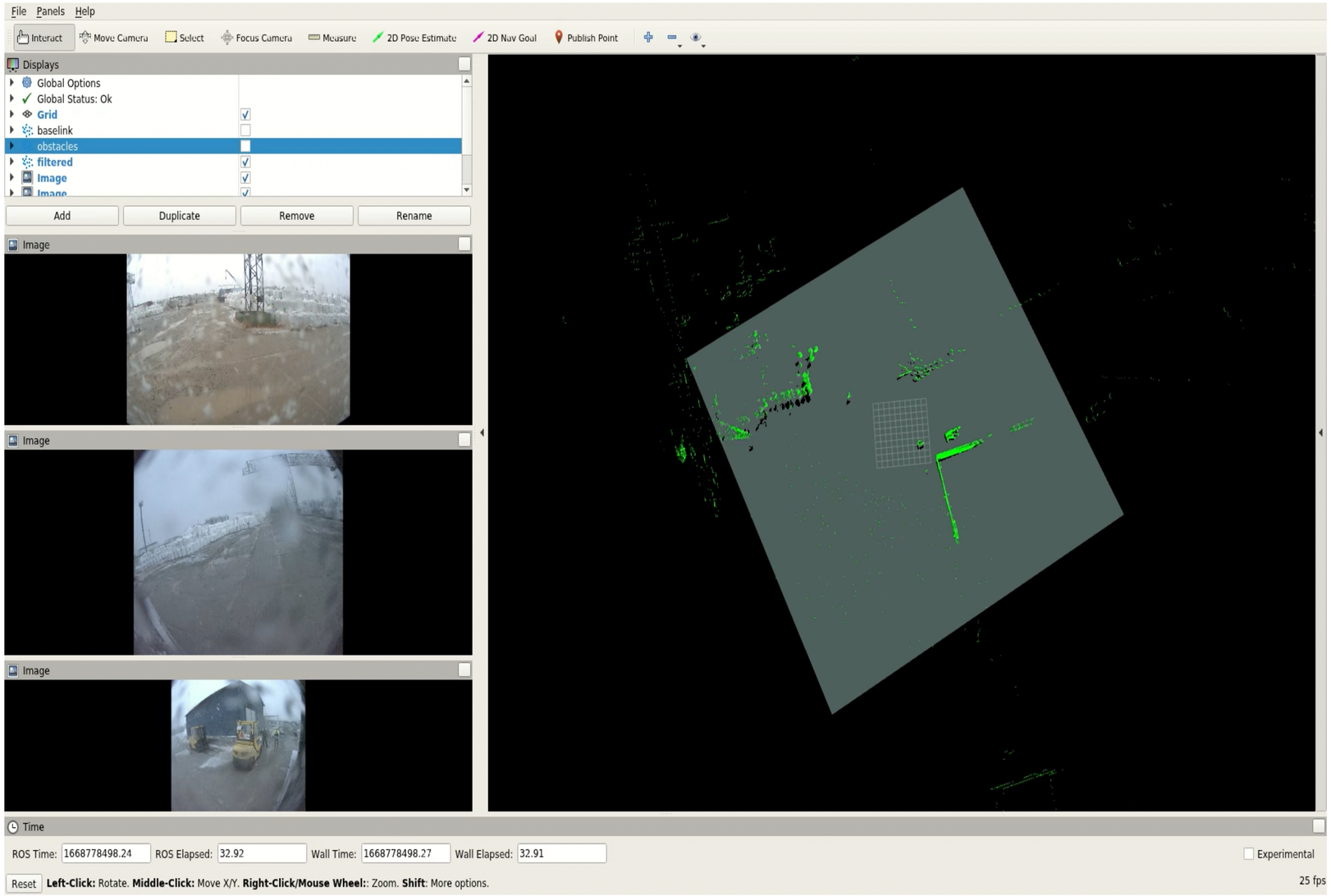
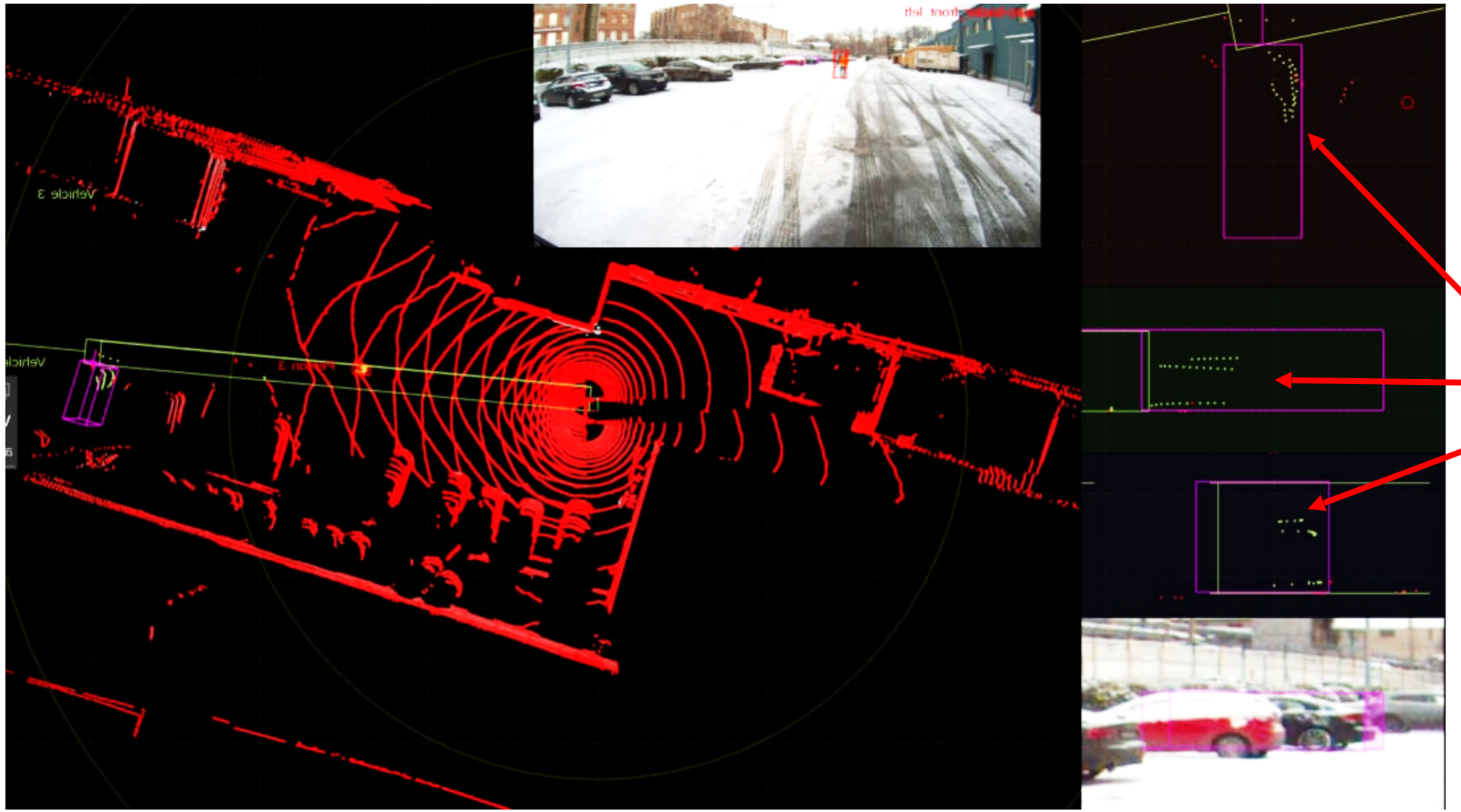
Lidar Limitations



- Snow
- Rain
- Fog
- Smoke
- Dust

Lidar Limitations

EVOCARGO



Black car's points

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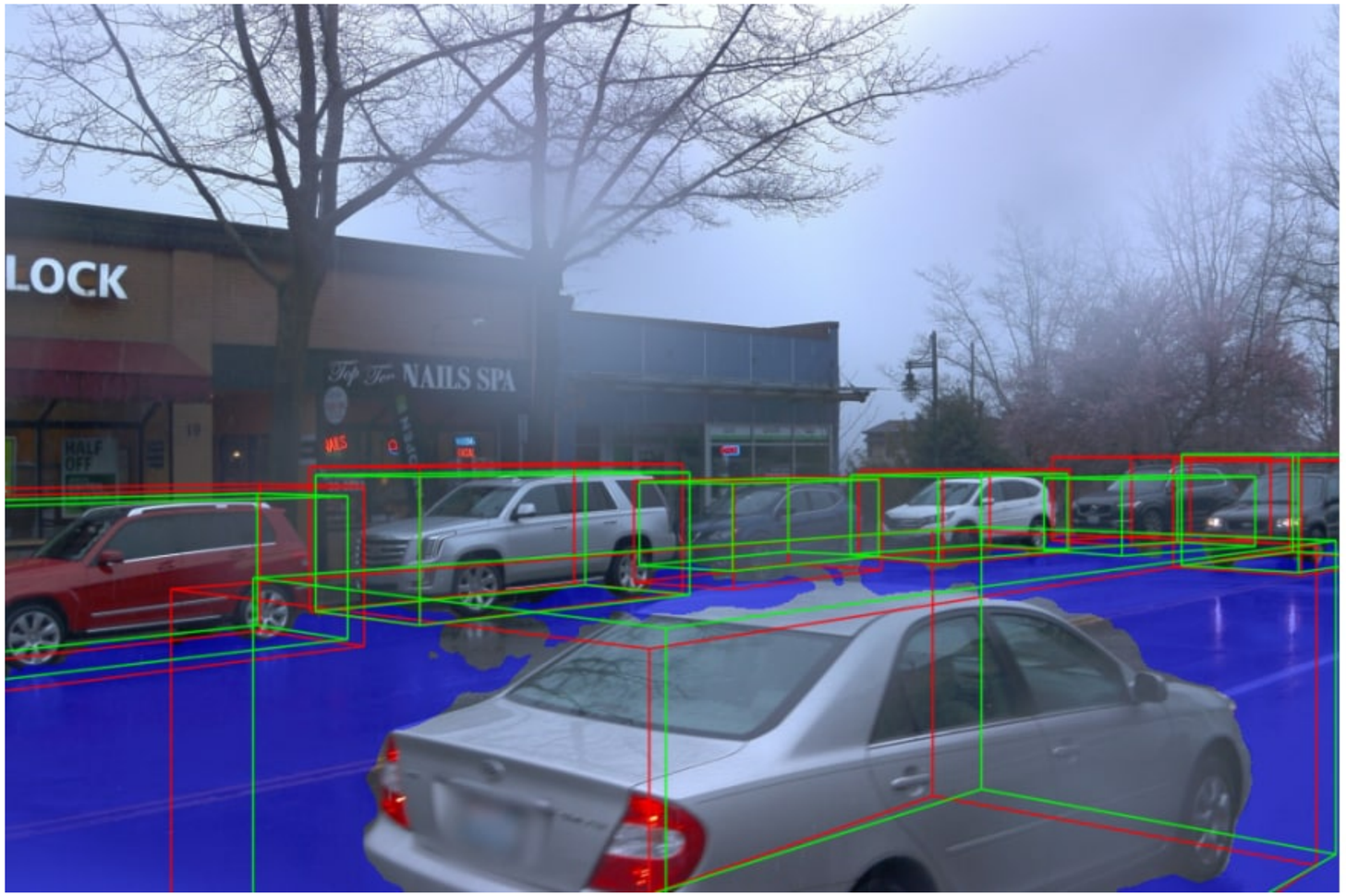
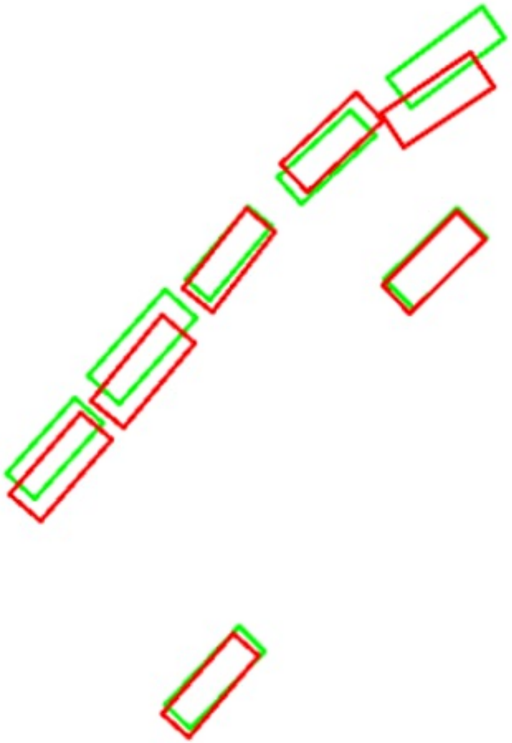
Further Research

EVOCARGO





[Learning Auxiliary Monocular Contexts Helps Monocular 3D Object Detection]

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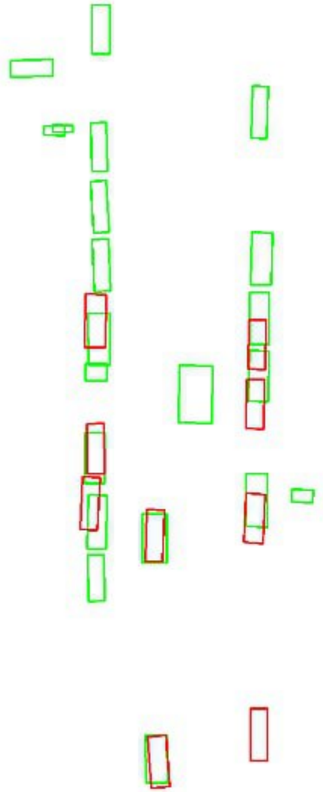
Further Research

EVOCARGO



[Learning Auxiliary Monocular Contexts Helps Monocular 3D Object](#)

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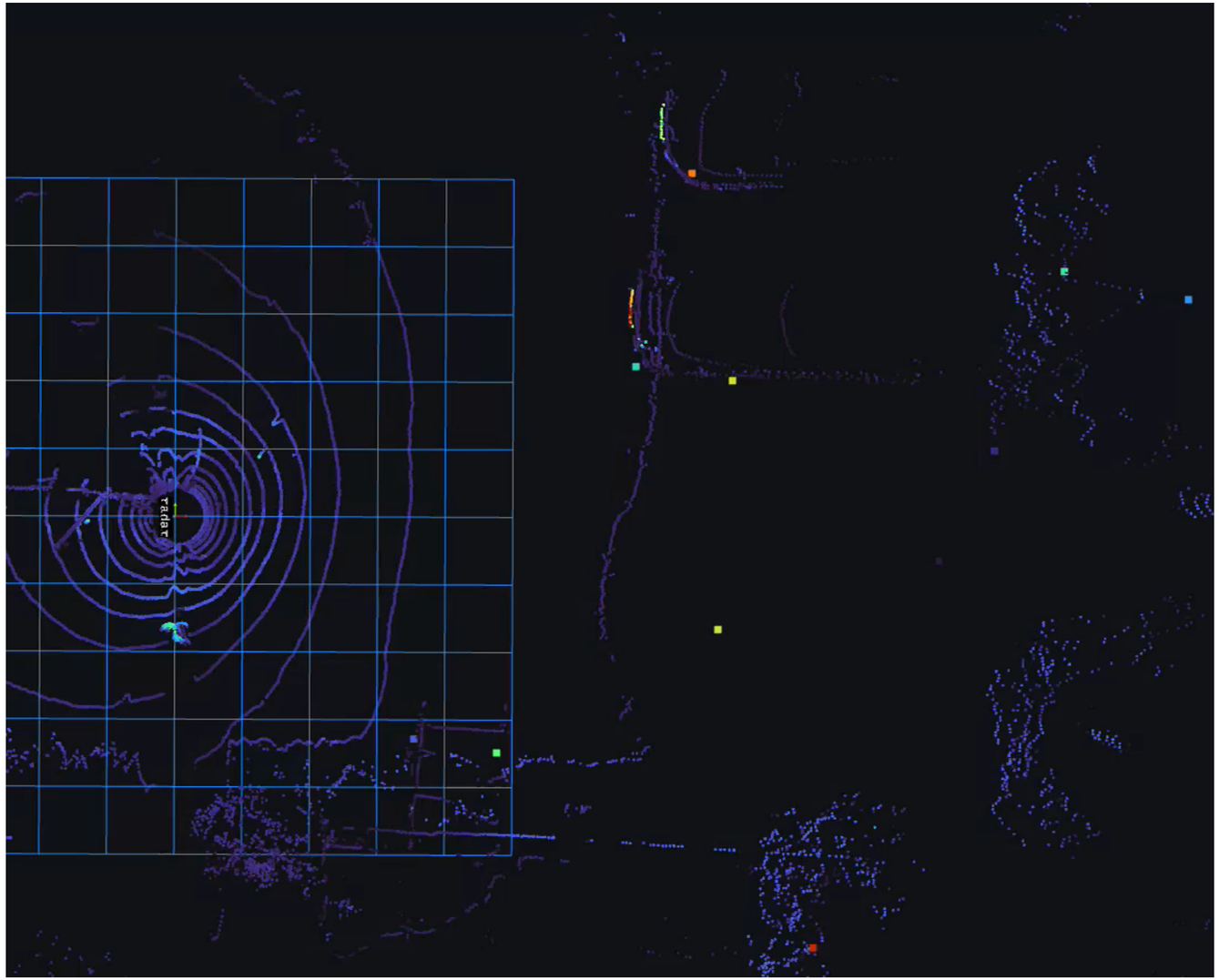
Radar Sensor

EVOCARGO



ARS408 -250meters

Automotive forward collision avoidance radar

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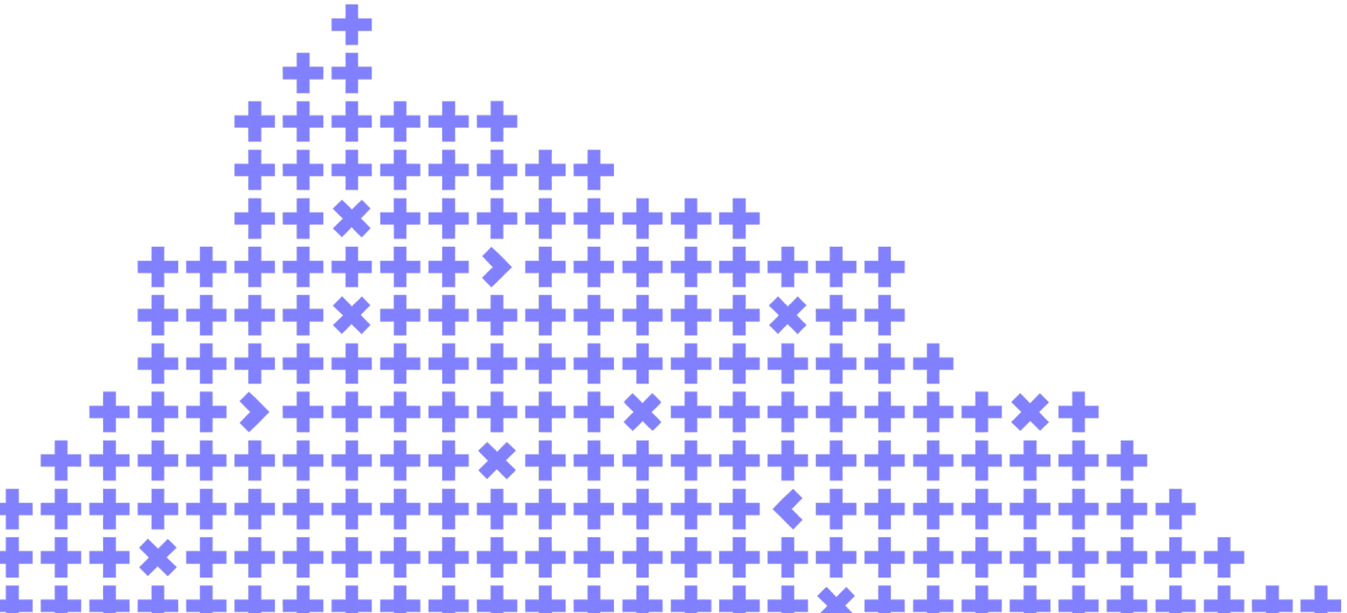
Leave your feedback!

You can rate the talk and give feedback on what you've liked or what could be improved



High Load Armenia

Co-organizer

Yandex